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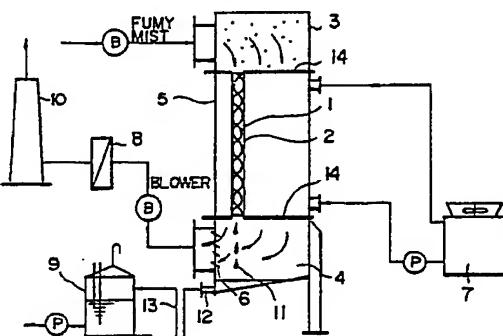
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(54) Mist recovery apparatus with twisted strip inserted pipes.

(57) A mist recovery apparatus recovers the mist of water, oil and the like from the fumy or gassy exhaust produced in the rolling operation of aluminum plates. The apparatus has a shell (5) provided with a pair of upper and lower pipe plates (14) and a plurality of exhaust passing pipes (2) extending between the upper and lower pipe plates (14) and each having a twisted strip (1) therein. The shell has an upper casing (3) and a lower casing (4), which are placed above the upper plate (14) and beneath the lower plate (14). The exhaust containing mist flows through the upper casing (3), respective exhaust passing pipes (2), and the lower casing (4) sequentially. These exhaust passing pipes (2) are cooled by a coolant passing through and around the pipes, so that the mist are removed from the exhaust and recovered. The experimentally suitable ratio of the length (L) of the exhaust passing pipe and the twisting half pitch (P) of the twisting strip is 8 - 35.

FIG. 2



## MIST RECOVERY APPARATUS WITH TWISTED STRIP INSERTED PIPES

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to an apparatus for recovering mist from the exhaust containing the mist of water and oil, etc.

#### 2. Description of the Prior Art

Heretofore, the exhaust containing mist of steam, rolling oil and the like, which mist is produced from a roll coolant when, for example, aluminum plates are rolled, has been treated through, for example, a filter installation as shown in FIG. 5 so as to remove the mist. In detail, the exhaust G containing the mist supplied through an exhaust line 21 passes through a coarse mesh filter 23, a middle function filter 24, and a high function filter 25, respectively of the filtering chamber 22 sequentially and is discharged to the atmosphere from an outlet 26. Flowing through such filters of the filtering chamber 22, the mist is held or kept in respective filters and removed from the exhaust.

According to other filtering mechanisms of the prior art, one has a plurality of corrugated plates arranged in parallel, through which plates exhaust passes and the another of a cyclone type.

In the conventional filtering apparatus as shown in FIG. 5, the mist is held and deposited on the mesh of filters, deteriorating the recovery effect of the mist gradually. As a result, when the filter mesh is clogged with the mist, the old and clogged filter must be replaced by a new one. It is apparent that the maintenance cost is high, because the filter is high in price and their replacement work is laborious. In many cases, since the mist content of the exhaust is gasified in the state of supersaturated condition and passes through the filter mesh, there is a risk that the mist is discharged as it is to the atmosphere. The size of the conventional mist recovery installation must be of large in order to lessen a draught resistance or pressure of air.

Other apparatus of a corrugated plate type and a cyclone type, respectively have little or poor effect of recovery of mist.

### SUMMARY OF THE INVENTION

In view of the foregoing, it is the purpose of the present invention to provide a mist recovery ap-

paratus of a small size, easy manuability, and a good recovery efficiency.

The purpose above is attained by providing a mist recovery apparatus comprising a pair of an upper pipe plate and a lower pipe plate, respectively contained in a shell, and a plurality of exhaust passing pipes, each having a twisted strip arranged therein, wherein the exhaust containing the mist of water, oil, etc., is flown downward through these exhaust passing pipes so as to separate and recover the mist from the exhaust, the inner diameter of the exhaust passing pipe is 25 - 60 mm, and the twisted strip has L/P (length of the exhaust passing pipe / twisting half pitch of the twisted strip) of 8 - 35.

### BRIEF DESCRIPTION OF THE DRAWINGS

- 20 FIG. 1 is a perspective view of the vertical section of the exhaust passing pipe to be used in the mist recovery apparatus according to the present invention;
- 25 FIG. 2 is an explanation view showing one example of the mist recovery system containing the mist recovery apparatus of the present invention;
- 30 FIGS. 3 and 4 are graphs depicting the relationship between diameters of the particles to be arrested and L/P; and
- 35 FIG. 5 is a section of the conventional filter apparatus.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First the construction of the exhaust passing pipes according to the present invention will be explained. As shown in FIG. 1 (vertical section), a twisted strip 1 is placed within the exhaust passing pipe 2. A number of the exhaust passing pipes 2 are arranged between the upper and the lower pipe plates 14 within the shell 5 and both ends of each passing pipe 2 pass or penetrate through the pipe plates so as to open to the interiors of an upper casing 3 and a lower casing 4, respectively.

Exhaust containing fumy mist is supplied to the upper casing 3 through a blower B and, then, the exhaust flows into the exhaust passing pipes 2 open to the interior of the upper casing 3. Flowing through the exhaust passing pipes, the exhaust contacts with the twisted strips 1 and the inner walls of the exhaust passing pipes 2 and flows

down vertically within the passageway formed by the twisted strip 1 and the inner wall of the exhaust passing pipe 2. The mist is separated and deposited on the outer surface of the twisted strip 1 and the inner wall of the exhaust passing pipes 2. The remaining of the exhaust enters the lower casing 4 and flows through a louver 6. After that, the remaining is sucked by a blower B and forced into a filter 8 through a conduit connecting the lower casing 4 and the filter 8. In the filter 8, fine mist of, for example, 10  $\mu\text{m}$  or less, is separated from the remained exhaust and, then, the exhaust is discharged to the atmosphere through a chimney or a discharging column 10.

Coolant, which is cooled by radiating heat in a cooling tower 7, circulates through the shell 5 in order to cool the exhaust passing pipes 2 through their outer walls.

Mist deposited or liquid condensed onto the inner wall of the exhaust passing pipes 2 and the surface of the twisted strips 1 within the exhaust passing pipes 2 fall into the lower casing 4 and recovered. The recovered mist 11 is collected to an oil separator 9 through a drain outlet 12 and a U-shaped tube 13.

Because the exhaust passing pipes 2 of the present invention each have a twisted strip 1 therein and the gassy flow of the exhaust becomes a vertical flow during descending through the exhaust passing pipes 2, mist of several  $\mu\text{m}$  or more in diameter is effectively arrested and saturated stream in the exhaust is effectively liquefied and recovered due to the heat transfer acceleration effect of the twisted stripe 1.

The twisted strips 1 are made of metal, such as stainless steel and aluminum alloy or the like and have their outer diameters a little smaller than the inner diameter of the exhaust passing pipes 2. The twisted strips 1 may be a suspension type and the twisted strips 1 are easily removed after a lid of the upper casing 3 is dismantled.

The inner diameter of the exhaust passing pipe 2 and the twisting half pitch P of the twisted strip 1 are important in improving the mist arresting efficiency.

First, preferably, the inner diameter of the exhaust passing pipes 2 is 25 - 60 mm. If the diameter is less than 25 mm, the resistance to flowing of the mist increases and pressure loss increases, so that the number of the exhaust passing pipes 2 to be installed or used in the shell 5 is necessary to increase, resulting disadvantageously in an enlargement of the shell 5 and the mist recovery apparatus. Also, if the inner diameter of the exhaust passing pipes exceeds 60 mm, it is necessary to lengthen the exhaust passing pipes 2 in order to attain a sufficiently intimate contact of the mist with the inner wall of the pipe 2, resulting

in an large size of the mist recovery apparatus. Eventually, the preferable size of the inner diameter is 25 - 60 mm, again.

5 The twisting half pitch P of the twisted strip 1 will be concretely explained with reference to FIG. 3 and FIG. 4.

10 The exhaust passing pipes of 25 mm and 60 mm in their inner diameter are prepared and exhaust is flown through at a speed of 8 m/s. FIG. 3 and FIG. 4 show the relationship between the particle diameter of the mist arrested and L/P (the length L of the exhaust passing pipe 2 and a twisting half pitch P of the twisted strip 1).

15 FIG. 3 is for the mist of kerosine and FIG. 4 is for the mist of water, respectively.

20 As apparent from the graphs, 20 - 35 of L/P is preferable in case that the mist is kerosine and 8 - 16 of L/P is suitable when it is water. In general, 8 - 35 is preferable to L/P.

25 As described above, the technical effects to be obtained by embodying the present invention are summarized as follows:

25 1. The mist contained in the exhaust can be recovered effectively at, for example, about 95%, so that a great pollution prevention effect can be obtained.

30 2. It is possible to recover elements of the mist and reuse them. According to one of the recovery of kerosine, it is possible to repay the cost of the mist recovery installation for about 1.7 years.

35 3. The heat transfer efficiency of the exhaust passing pipes is improved and the gas cooling effect increases so that liquification of steam in the exhaust is accelerated.

40 4. Because outer surfaces of the twisted strip are smooth, liquid flows down smoothly and rapidly.

45 5. Any pollution and dirt stucked on the inner wall of the exhaust passing pipe are washed off.

(i) Due to a vertical flow created on the twisted strip, a great washing effect is obtained.

(ii) The twisted strips are not secured to the exhaust passing pipes, so that they are easily taken out of the exhaust passing pipes for inspecting and cleaning them.

### Claims

50 (1) A mist recovery apparatus comprising a shell, a pair of an upper pipe plate and a lower pipe plate respectively arranged in said shell, and a plurality of exhaust passing pipes each having a twisted strip placed therein, wherein the fumy exhaust containing the mist is flown downward through said exhaust passing pipes so as to separate and recover said mist from said exhaust, the inner diam-

eter of said exhaust passing pipe is 25 - 60 mm, and said twisted strip has a ratio of L/P (length said exhaust passing pipe/twisting half pitch of said twisted strip) of 8 - 35.

(2) A mist recovery apparatus as claimed in Claim 1 in which said mist recovery apparatus includes a cooling tower adapted to cool the coolant to be circulated through said shell so as to cool said exhaust passing pipes.

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FIG. 1

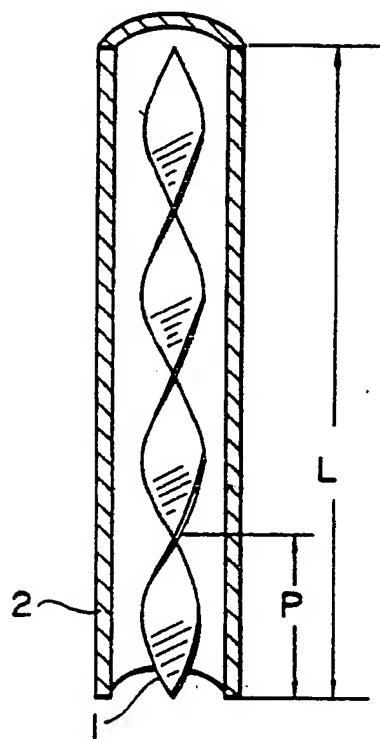


FIG. 2

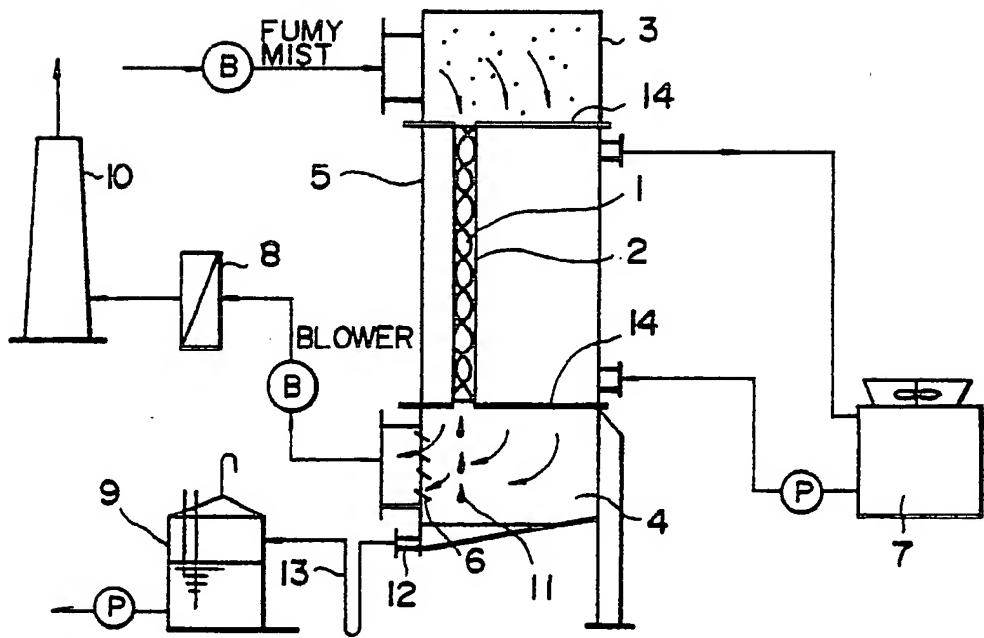


FIG. 3

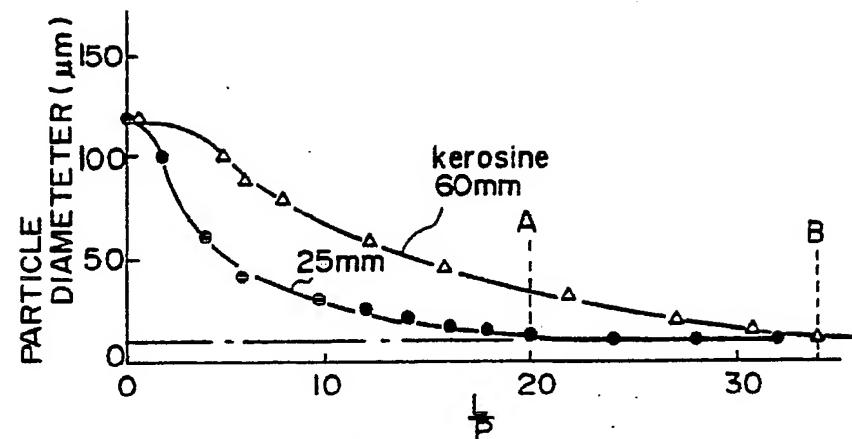


FIG. 4

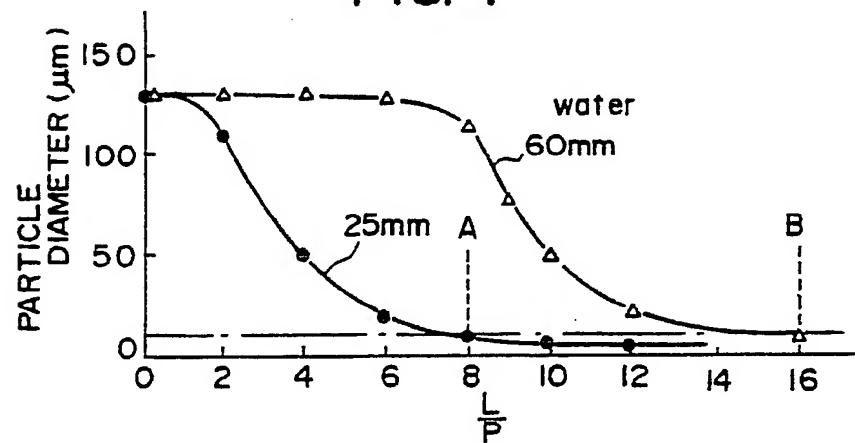
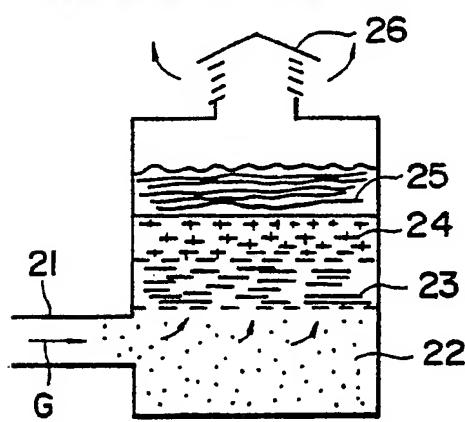


FIG.5  
PRIOR ART





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REPORT

Application Number

EP 90 11 1577

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)		
A	US-A-4 382 807 (W. DIACHUK) * Abstract; figure 6 *	1	B 01 D 45/16 B 01 D 50/00		
A	US-A-4 516 994 (E.J. KOCHER)				
A	US-A-4 043 774 (D.W. McGRATH)				
A	US-A-1 773 954 (J.G. CONTANT)				
TECHNICAL FIELDS SEARCHED (Int. Cl.5)					
B 01 D 45/00 B 01 D 46/00					
The present search report has been drawn up for all claims					
Place of search	Date of completion of search	Examiner			
The Hague	20 September 90	POLESAK, H.F.			
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